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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Research and Lubrication in Textile Machinery Development

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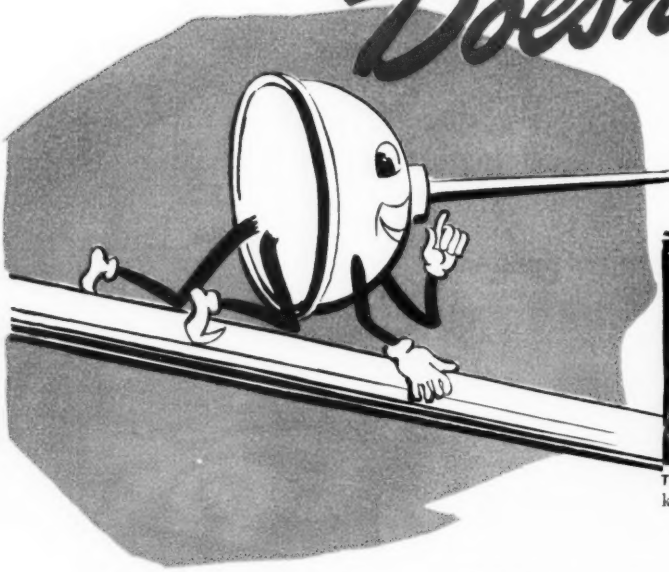

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FOR THE TEXTILE INDUSTRY

LUBRICATION

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Research and Lubrication in Textile Machinery Development

TEXTILES are vitally related to national defense. 70 yards of silk are required per parachute; 19 pounds of wool for a soldier's uniform and blankets; and 17 pounds of cotton for other uniform equipment.

Translated into broader statistics, this means that some 25½ million pounds of cotton will be used this year for the army with around 28½ million pounds of wool. Along with this an inestimable amount of synthetic textiles will be used in place of raw silk, and perhaps as a substitute for jute and flax for cables and hawsers in marine operations.

The necessity for developing suitable substitute materials for raw silk, jute, flax and hemp is particularly acute. Silk has always been very well suited for aircraft parachutes as it stands storage so effectively. Today, however, research is most actively studying the applicability of rayon, nylon and other similar materials. Research likewise is endeavoring to develop suitable substitutes for jute and hemp.

So it is no wonder that the textile industry takes itself seriously. In this attitude it distributed certain of those problems incident to more dependable production to machinery builders and the petroleum industry. Ball and roller bearing manufacturers received the bearing assignment; spindle manufacturers, the job of developing even better spindle steels; loom and frame designers the task of building higher speed equipment; and the petroleum industry the responsibility of producing lubricants which would protect the resultant intricate mechanisms.

Evaluation of the ability of any specific lubricant to function effectively in textile service requires correlation of operating conditions with features of construction and the characteristics of the lubricant. In other words, lubrication of textile machinery has progressed beyond the stage of hit-or-miss buying.

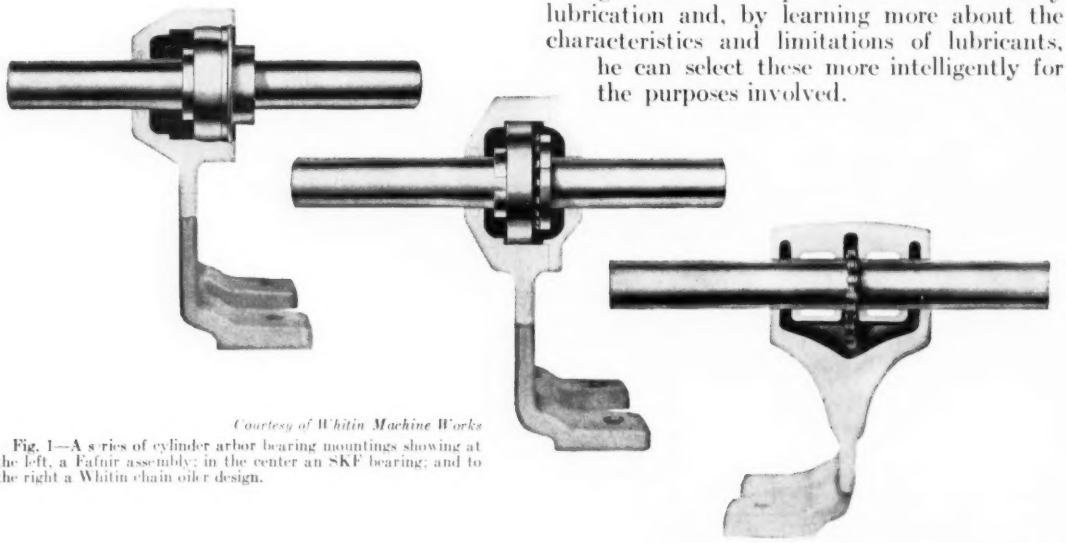
There are three outstanding reasons for this transition:

1. Textile machinery operators realize more fully than ever the amount of investment which but a few dollars worth of lubricants must protect.
2. Machine designers today plan for protected lubrication, even in the drafting room stage.
3. The petroleum industry, in becoming more familiar with textile operating conditions, has perfected lubricants of specific characteristics which will function more dependably under these conditions.

The protective value of lubrication for the machinery investment is seldom fully realized. Textile machinery is not classified entirely in the so-called heavy industry group. What it lacks in bulk or massiveness, however, is made up by intricacy and the necessity for precision. So the machinery value becomes a considerable part of the fixed assets account.

In turn lubricants for the protection of such machinery are classified in the inventory account. As it is human nature to work towards

keeping the inventory low, lubrication is too often regarded by some as a necessary evil, and one where the materials required should be obtained at the lowest possible cost. The result being the responsibility of the plant maintenance department to protect machinery worth many thousands of dollars with but a few dollars worth of lubricating oil and grease per year.



Courtesy of Whitin Machine Works

Fig. 1—A series of cylinder arbor bearing mountings showing at the left, a Fafnir assembly; in the center an SKF bearing; and to the right a Whitin chain oiler design.

As production demands have increased, however, it has become more fully realized that machinery must be kept operating to meet these demands. This has brought the plant maintenance personnel into the picture, along with those specifically responsible for the lubrication program. Textile school training, or years of plant experience, have developed the necessary respect for lubrication among them; also, respect for the dollar value of the parts to be lubricated.

This has been a fortunate transition for the petroleum industry as we have been relieved of the educational part of the program to a large extent, though the price wars with those responsible for purchases still flare up at times. Still this has allowed more leisure for petroleum chemists and engineers to study the operating conditions in textiles and to follow new developments in machine design, all of which are so essential in guiding oil refinery and grease compounding procedure.

BEARING RESEARCH

The trend towards more extensive use of the ball and roller bearing, super-finish and lower tolerances in sleeve bearings and the application of more positive means of lubrication have contributed to marked lowering of maintenance costs. This has been a welcome relief to the mill mechanic. Today he can study improvements in machine operation instead of fixing up good reasons why the spare parts bill is so high. Along with machine operation he can also study lubrication and, by learning more about the characteristics and limitations of lubricants, he can select these more intelligently for the purposes involved.

Literally speaking, any machine is only as good as its bearings. To be sure, there are other diverse parts and mechanisms which often must be lubricated with equal care, but partial failure (as evidenced by wear) may not necessarily mean shut down for repair. Bearings of today are so precise in design, that any misalignment may seriously interfere with production. Visualize a loose fitting top-roll bearing or a rattling loom-cam bearing.

So textiles went to precision workmanship on sleeve bearings, and to ball and roller bearing with enthusiasm, aided and abetted by the metallurgists and the designing engineers of the bearing industry. The latter developed precision to a theretofore unheard of degree. Then they worked with textile machinery builders in the study of application problems.

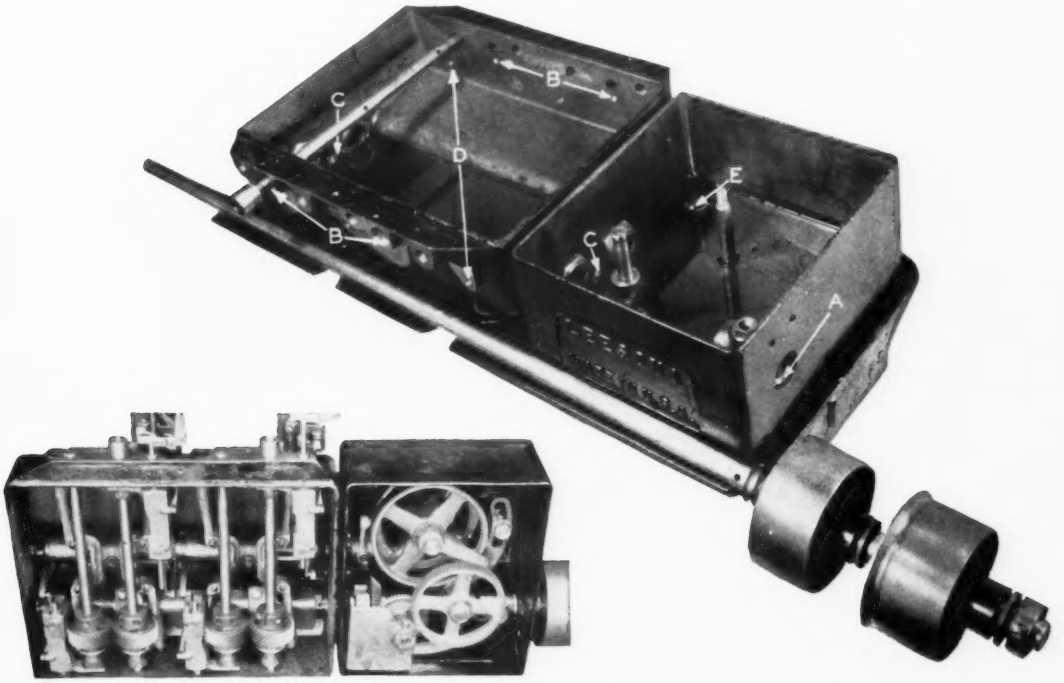
Precision proved to be one of the primary essentials to maximum production. Fortunately, there was time to study this relationship during the doldrum period of the early '30s. When the trade winds carried the industry into the peak production phase of the cycle, no one was caught napping. The metallurgist had produced new types of bearing metals and alloy steels, the bearing designer had perfected the pre-lubricated unit or cartridge type of ball bearing, the machine designer had developed applications beyond his fondest expectations and the petroleum chemist had produced greases which would protect these applications most dependably.

Where the Grease Chemist Came in

It is fitting to discuss the transitions in lubricant manufacture which occurred during this period. Lubricant application controls the type of lubricant. When ball or roller bearings, or any type of plain or sleeve bearing surface could be lubricated periodically by means of a pressure gun or grease cup, nobody worried much about oxidation; it was easy to free most of the bearing clearances of used and perhaps oxidized grease at the next application of the gun. Sometimes a little corrosion occurred on balls, rollers or raceways, perhaps they actually stuck and became scored. But it was not too serious a problem, even if a new bearing had to be installed. Furthermore it was an ideal set-up for the price buyer, as he could purchase the cheapest kind of cup grease and then fight with both his lubricating engineer and bearing designer when a failure occurred.

When the grease chemist came to the rescue study he took advantage of the fact that petroleum oil, which is the lubricating component in any grease, contains hydrocarbons, some of which break down and oxidize readily, others of which inhibit oxidation. The problem was to segregate these during refinement, removing those which might break down, and retaining the others. Automatically, this improved the chemical stability of the oil, a feature which is so widely stressed today.

Then he studied fats and mineral soap bases. To improve the former, he applied methods of pre-oxidation prior to their saponification with the base. This produced some interesting combinations which were then carefully checked on the variety of laboratory grease testing equipment discussed in the December 1940 issue of LUBRICATION. Most interesting results were obtained. After prediction of the resistance to oxidation, a grease could be studied for torque or power consumption, for leakage and for expansion or thickening.



Courtesy of Universal Winding Company

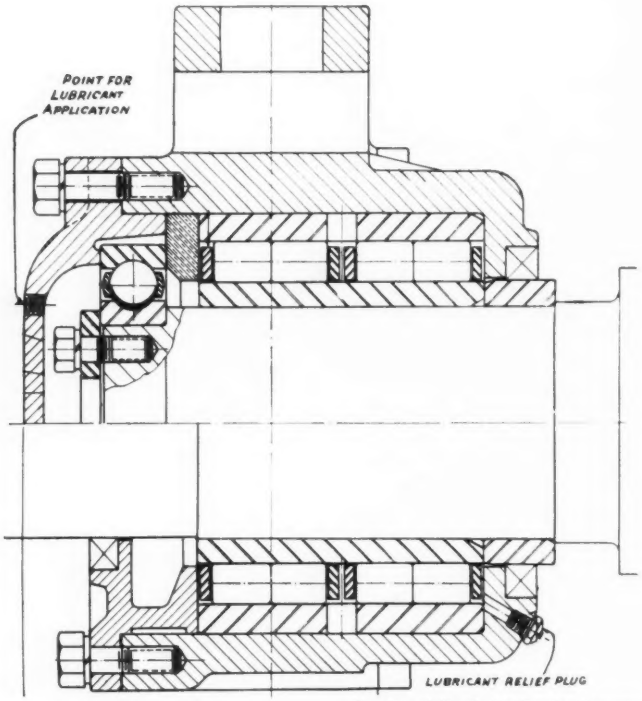
Fig. 2—Universal prevents oil leaks in winder operation by designing their gear box as indicated. (A) is a return oil hole which allows oil escaping along the drive shaft to return into the case. In case of leakage along the spindle, the oil will be slung off, returning to the frame through oil holes (B). (C) shows oil tubes between the cases; these can be tightened at regular intervals. To prevent oil from leaking at the traverse bar support bracket (D) the holding nut should also be kept tight. Oil in the case is considered at the proper level when the top of boss (E) is just exposed over the surface of the oil.

the tables were turned. With knowledge of the relative oxidizability of the various components employed in grease manufacture, he developed methods of compounding those products which were most resistant to oxidation. During this

Power Consumption must be Low

This is a most important item in textile machinery lubrication. It can be more fully realized by visualizing that sometimes upward of a hundred ball or roller bearings can be

applied to certain types of frames, etc. The unit power consumption per bearing may seem negligible, but over the machine as a whole it may become a serious item and materially affect the motor capacity especially if unsuitable greases are used.



Courtesy of The Fafnir Bearing Company

Fig. 3—A textile printing machine cylinder equipped with Fafnir ball bearings.

By this term "unsuitable" we do not infer quality, but rather ability to protect the ball or roller bearing elements and at the same time require the least amount of power for turning. A grease which is too heavy or tacky may show so high a starting or running torque in the bearing as to render its use prohibitive. Yet, for durability, resistance to temperature and low oxidation characteristics it might be ideal.

So, the grease chemist has to take this matter of torque into consideration when studying the make-up of ball or roller bearing greases for textiles and motor purposes. A buttery or short fibre texture has proved to be most conducive to low torque. Furthermore, these characteristics must prevail over a wide temperature range, for textile service may require starting sometimes under nearly zero weather conditions; and operation considerably above 100 degrees Fahr. As many of the bearings are of the high speed type, the operating temperature within may be even higher. Obviously, if the balls or rollers must drag through or roll against a channel of grease which is too adhesive, power consumption as well as temperature due to internal friction are adversely affected.

The Effects of Oxidation

Oxidation in petroleum greases results from inability of one or more of the constituents to withstand the effect of oxygen. It is indicated by a rancid odor, by change in color and texture of the grease and development of gummy or varnish-like deposits which are often very sticky. As acidity is also developed a corrosive effect on the highly polished rolling elements may result.

In order to study oxidation, laboratory methods to simulate operating conditions were perfected. In reality these accelerated the usual long-time storage tests which have always been so valuable to both petroleum and bearing research personnel in predicting how a grease or a combination of grease plus the bearing metals would resist the break-down effects of air, normal humidity and average fluctuations in temperature. Accelerated methods of oxidation especially if they simulate operating conditions by changing the surface of the lubricant and permit of temperature as well as moisture control are the latest objective of the grease chemist. In days he can develop data which is comparable to months or even years of storage; furthermore, he can observe the effect of stabilizing additives.

SPINDLE PROBLEMS

Spindle design under modern high speed operating conditions has a direct relationship to lubrication. The spindle oil must perform a dual function under such conditions, serving:

(1) As a shock absorbing element or buffer to prevent vibration or hunting, and

(2) As a lubricant in the reduction of frictional wear and attainment of power economy.

Just how the oil must behave to assure of best results will be of interest. There was a time when low power consumption was the most talked of factor. Naturally, it was given very serious consideration since it involved such a noticeable percentage of the entire amount of power consumed by the average mill. More recently, however, in the advanced study of spindle design, unit power consumption has been associated with other factors which have been found to have a combined

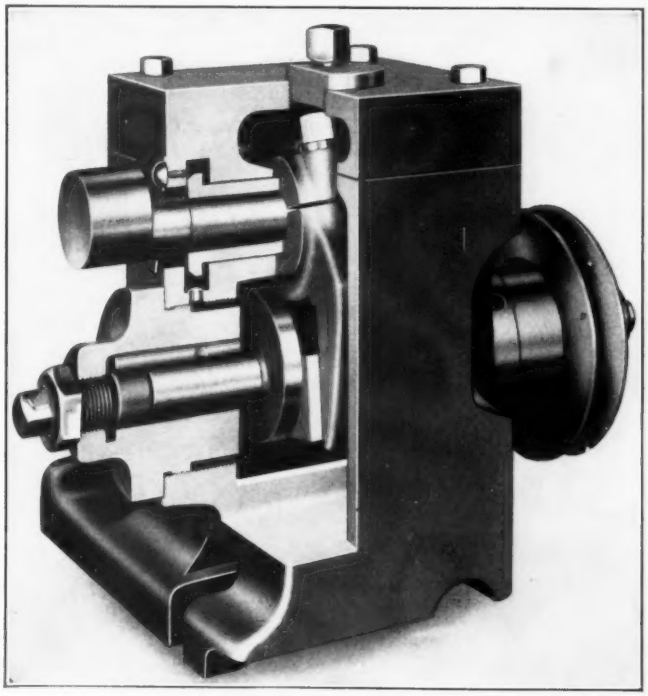
influence upon the maximum production of quality yarns.

These factors involve resistance to atomization, minimum increase in viscosity and low corrosive tendency. All are functions of the chemical stability of the oil. In other words, just as the modern spindle is designed to operate on an oil within a very definite viscosity range, according to the speed, package weight and traverse length so must this oil, in turn, stay within this viscosity range without sludging or in any other way changing its physical characteristics. Otherwise the basic purposes will be defeated.

Vibration Affected by Speed

Spindle speeds in the modern spinning frame have been materially increased in recent years. From a former high of some six or eight thousand R.P.M. an average of ten thousand now prevails in cotton mill operations with twelve to fifteen thousand in the silk and rayon industry.

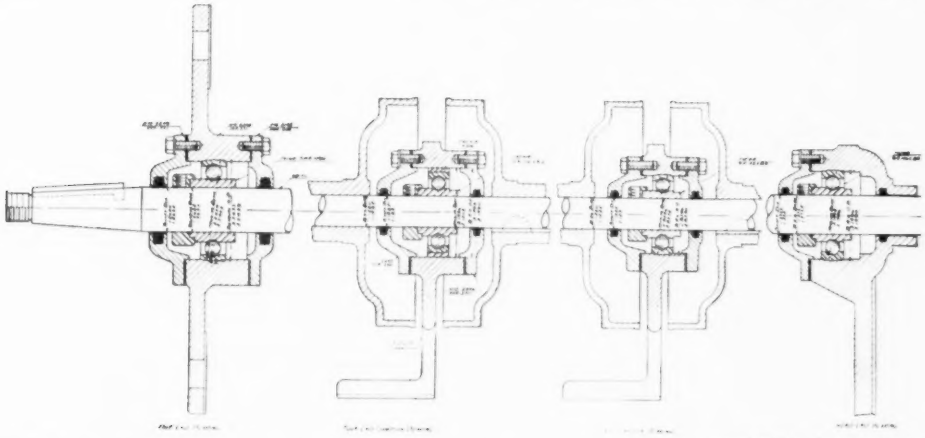
Speeds of this nature develop conditions of vibration which may cause faulty spinning with an excess of end breakage, unless this vibration is prevented. It is impracticable to design the spindle base and bolster as to entirely accomplish this result, hence one of the primary functions of the spindle oil as a shock-absorbing assistant.



Courtesy of Saco-Lowell Shops.

Fig. 4—Cut-away view of a Saco Lowell comb box assembly. On the front there is a drilled oil level and breather hole, which is also used when supplying fresh lubricant.

grade steel can be accurately machined to a virtual mirror finish. Bolsters, however, are of cast iron, hence they must be run in to bring about a suitable glaze which will be conducive not only to continued lubrication but reduced wear. Unless this surface glaze is properly developed shortly after the spindle assembly is put in operation, vibration cannot be effectively prevented.



Courtesy of Whitin Machine Works

Fig. 5—A series of ball bearing cylinder boxes for Whitin spinning frame service.

Relation of Surface Finish to Lubrication

For lubrication to be most effective the contact surfaces of the spindle and bolsters must be as perfect as possible. Spindles being of high

In order for a lubricating oil to function at

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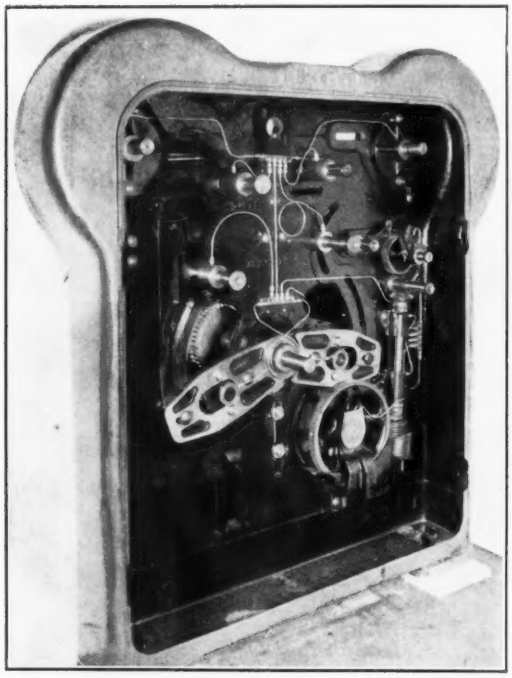


Courtesy of Whitin Machine Works

Fig. 6—Head end of a Bradford worsted type spinning frame showing the group oiling system.

its best it must be highly resistant to breakdown or oxidation. Should this occur in service, sludge may be developed to interfere with the cushioning or dampening ability of the lubricating film.

Viscosity and Temperature Difference

The selection of a spindle oil today must therefore be approached in a most careful manner. Unless the oil in service is able to function with a minimum of drag, power or friction losses, uneven or irregular twist may occur. This will be indicated by a soft package and a radical decrease in the breaking strength of the yarn, also excessive end breakage. High power consumption will be the forerunner of such a condition. Temperature difference has come to be regarded as of vital importance in this connection and the difference which may exist between the room temperature and the temperature of spindles is now accepted as a primary indication of the lubricating and friction-reducing ability of a spindle oil. The ideal would be obviously an absence of any difference in temperature.

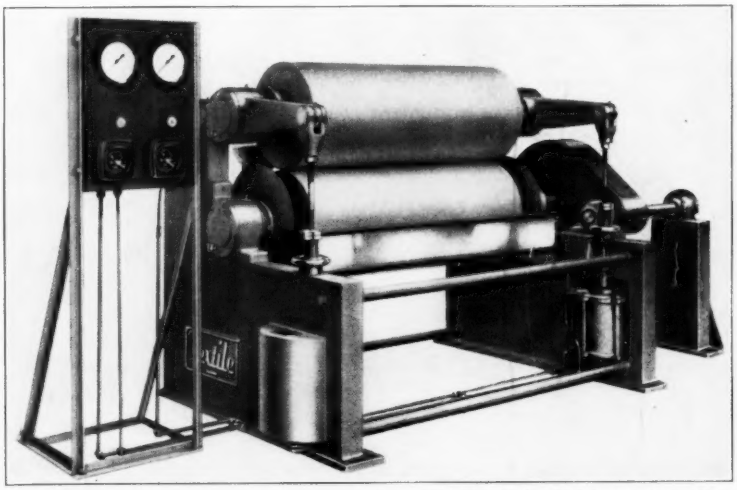
Friction can never be entirely eliminated, however; so spindle oils will almost always be subjected to an operating temperature somewhat above that of the surrounding atmosphere. With a high grade spindle oil this temperature difference may range from ten to fifteen degrees.

We are not alone concerned with contact or metallic friction, however, for there will also be the internal or molecular friction within the oil. Consequently the oil viscosity becomes an important item in this regard. Based upon research in spindle operation and design, certain viscosity limitations have been allocated to given types of spindles, where the operating conditions have been anticipated.

Reduction in viscosity of a spindle oil should never be carried to an extreme, due to impairment of oil film strength and the possibility of subsequent metal to metal contact. This would lead to an increase in metallic friction which would cause excessive wear and increased maintenance. Unfortunately this cannot be anticipated until the damage is done.

STOCK SPOILAGE THROUGH OIL STAIN

Many textile materials are subject to oil stain at some stage of their manufacture. While this is accepted by the industry as an unavoidable evil, it is not overlooked. The progressive operator will make every effort to prevent it, but until totally enclosed lubrication is perfected, the possibility of oil stain is highly



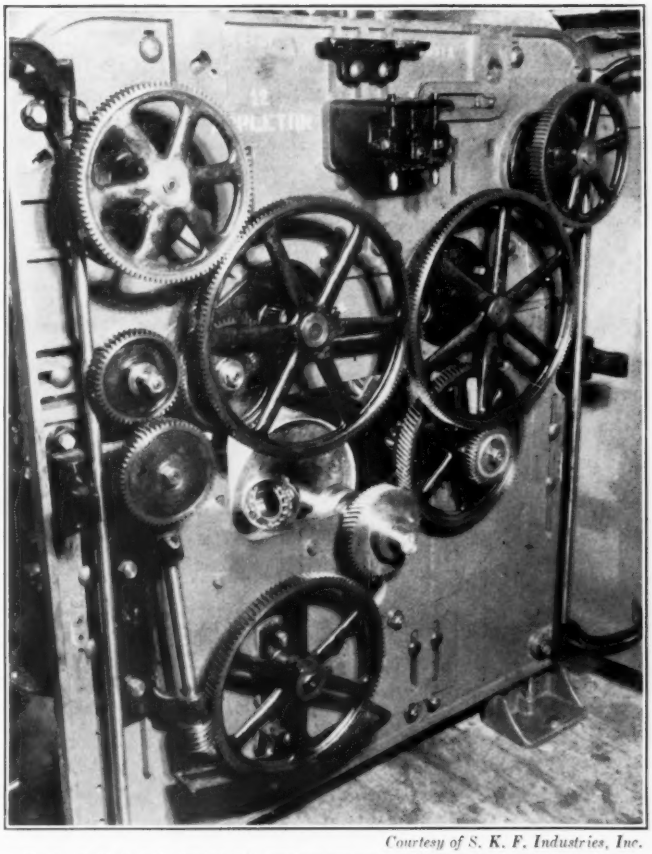
Courtesy of The Textile Finishing Machinery Co.

Fig. 7—A two-roll padder equipped with roller bearings and pneumatic pressure. These bearings have a labyrinth seal, also a splash guard to prevent entry of moisture; they are oil lubricated, though the seals are grease-packed. The needle bearings in the leverage system are grease lubricated.

probable. The nature of the stain will depend upon the point from which lubricant leakage occurs. If from overhead, spots may result. If from actual contact, streaks will usually develop.

In realization of this probability, methods of oil stain removal are given serious consideration. The problem is simplified by use of lubricants where oil or grease throw may occur, which can be emulsified during finishing and thereby removed from the goods. Oil stain is not always strictly oil as such, even though it may start as an oil spot or streak. Usually it is intensified by dust from the air and by the products of oxidation resulting from exposure of the oil stained goods to air, light and perhaps heat. Then the spot or streak becomes more apparent. It is impossible to entirely prevent dust accumulation unless air conditioning is practiced. Fortunately, this is becoming more popular in modern mill design along with control of the humidity.

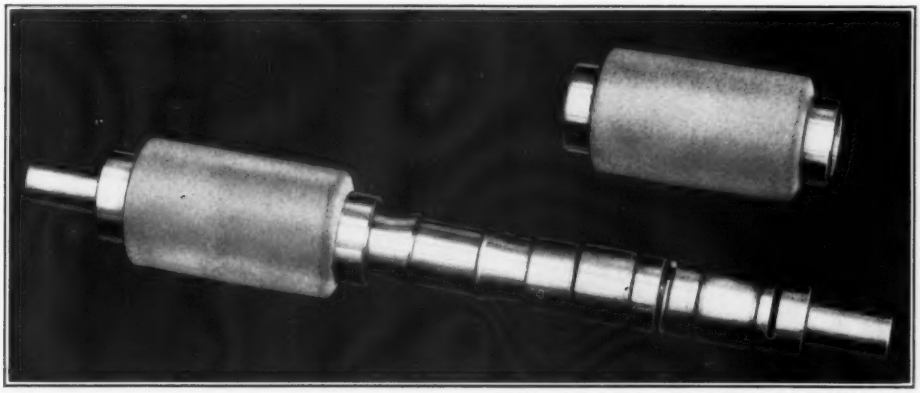
Oxidation is a direct function of the type of refinement of the lubricants used. Obviously an oil or grease which has been prepared in such a manner as to bring about removal of readily oxidized components is more resistant to the oxidizing effects of air, light and heat. In other words it has better chemical stability. It is easier to remove such a lubricant from most textile materials in finishing, than a product which has broken down and developed discolored gummy residues where the spotting has occurred.



Courtesy of S. K. F. Industries, Inc.

Fig. 8—S. K. F. self aligning ball bearings are used on the head end of spinning frames to insure correct and permanent location of the main drive gears.

A word as to the process of emulsification is therefore of interest. In service of this nature oils which separate relatively slowly from water have been proved most readily washed out in the subsequent finishing operations. This is a matter of distinct importance in the interest of preventing permanent oil stains.



Courtesy of Saco-Lowell Shops

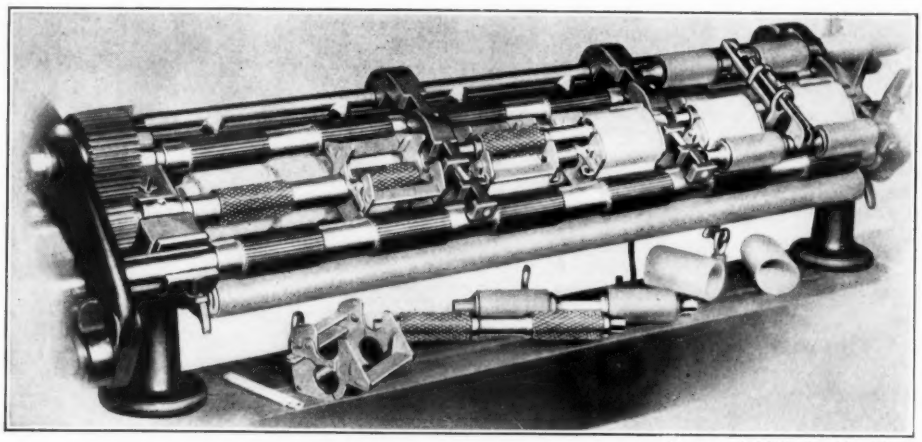
Fig. 9—Showing the Saco-Lowell top roll which is equipped with dust and lint-proof needle bearings designed for grease lubrication.

Formation of Emulsions

Positive emulsification can be developed by compounding with a fixed oil. What actually occurs in operation can be best understood by shaking a well refined mineral oil with water in a bottle, then allowing it to stand and settle for a few seconds. It will be noted that the respective liquids will separate, with a sharp surface of demarcation and that each will be comparatively clear. If, however, certain fixed oils or soaps are added to the mineral oil and the subsequent compound similarly agitated with water the two liquids will separate slower, or they may remain fixed for an indefinite period. The more intimate the mixture, the better and more lasting will be the emulsion.

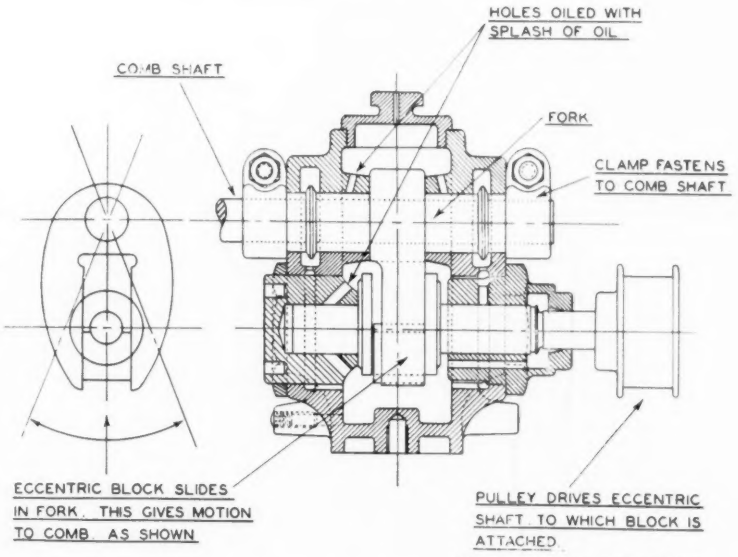
There are practically no limiting conditions which will definitely determine whether or not there is a complete emulsion, as the transition from a solution to an emulsion is not sharp, so it must be realized that in some cases an emulsion may exist and yet the resultant combination of certain oils plus water may appear to be a true solution due to the clarity.

Emulsification in its development is essentially a physical phenomenon, as it is brought about between mineral oil plus a fatty component and water. Where oil spots are to be removed from a textile fabric in any washing or finishing process by use of any aqueous alkaline solution, the subsequent development of saponification becomes a chemical reaction. The completeness of this reaction will be indicative of the extent to which oil spots can be removed. Inasmuch as this depends upon the initial degree of refinement of the lubricating oil and the purity of its fatty oil component, it is obvious that the emulsifying ability of the product should be carefully studied.



Courtesy of Whitin Machine Works

Fig. 10—Showing details of the Whitin steel roll assembly as applied to long draft spinning.


HOLES OILED WITH SPLASH OF OIL
COMB SHAFT
FORK
CLAMP FASTENS TO COMB SHAFT
ECCENTRIC BLOCK SLIDES IN FORK. THIS GIVES MOTION TO COMB AS SHOWN
PULLEY DRIVES ECCENTRIC SHAFT TO WHICH BLOCK IS ATTACHED

Courtesy of Whitin Machine Works

Fig. 11—Comb box details of the Whitin design showing relative location of the assembly and provisions for lubrication.

Theory of Emulsification

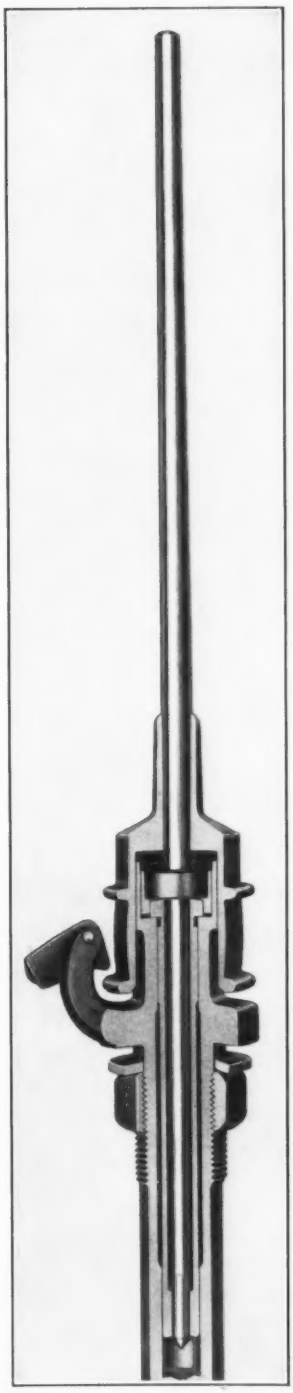
Although there are many features pertinent to emulsification which have not as yet been satisfactorily and completely explained accord-

ing to the usually accepted theories of physical and chemical science, great progress has been made, and sufficient experimental data have been accumulated to allow prediction of results with a fair degree of accuracy. The most generally accepted theory is that there is a balancing of physical and perhaps chemical forces at the surfaces between water and oil, so that there is no resulting tendency for the individual drops to either combine or become further subdivided.

With oils which lend themselves to ready emulsification, the prevailing forces are of sufficient intensity to prevent or at least so retard the action of gravity towards separation of liquids of different density, that they will remain in more or less permanent emulsion. There are some liquids, such as soluble oil, which will emulsify with greater rapidity, the particles reaching their final balanced state of subdivision very quickly. Others must be mechanically or otherwise atomized, before they remain permanent in suspension with respect to water. Laboratory examinations of certain types of emulsions indicate that the particles are so small that they can only be observed under an ultra-microscope.

Emulsibility, or the ability of an oil to emulsify is determined in the laboratory by agitation with water, and then noting the readiness with which separation of the resultant oil-water emulsion will occur. The object, of course, is to study the emulsifying tendency of the oil.

Wherever oil staining may occur, with subsequent necessity for washing of any type of textile material, the emulsibility as well as the subsequent demulsibility of any proposed lubricant must be given the most careful attention, not only when making initial selection and purchase of the product, but also in its subsequent usuage.



Courtesy of Saco-Lowell Shops

Fig. 12.—The Saco-Lowell ball bearing spindle.

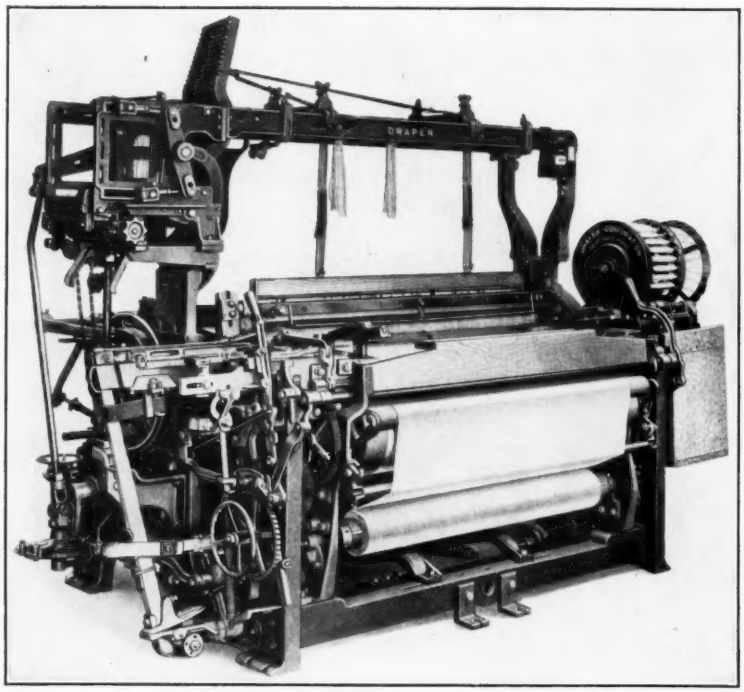
Saponification

Saponification is a factor in the production of oil-free textile fabrics by reason of its relation of effective washing. As its name implies, it is a chemical reaction having to do with the production of soaps by treatment of a fatty oil with certain types of alkaline solutions. In order for saponification to be most effective where textiles are involved, the soaps should be water-soluble. This will enable most complete removal of any oil or grease spots during washing or bleaching operations. Where dealing with oil spots both emulsification and subsequently saponification are essential; the more complete the former the more thoroughly can saponification be brought about with satisfactory removal of oily particles from the goods.

Removal of grease spots, however, should be a more simple matter, for due to the fact that saponification has already been accomplished, all that is necessary is to dissolve the existing soap. It is therefore important in the selection of greases for textile mill operators to investigate the nature of the soap content as to its solubility in water.

In studying the relation of saponification to textile machinery lubrication it is well to remember that one of the essential differences between fixed or fatty oils and mineral oils involves the ability or susceptibility of the former to undergo a simple chemical reaction whereby the original compounds are split up and their elements recombined chemically, generally with certain of the alkali group.

Combinations of the larger portion of the fatty oil molecules with a metal in this manner are termed soaps, the reaction being known as saponification. The more common soaps are produced by treatment of a fatty oil with caustic soda or potash. On the other hand, in the preparation of certain types of lubricants, it is also practicable to employ soaps containing lime (calcium), aluminum or lead. Although saponification is a characteristic which is normally foreign to petroleum or mineral oils, it should be understood that, dependent upon



Courtesy of Draper Corporation

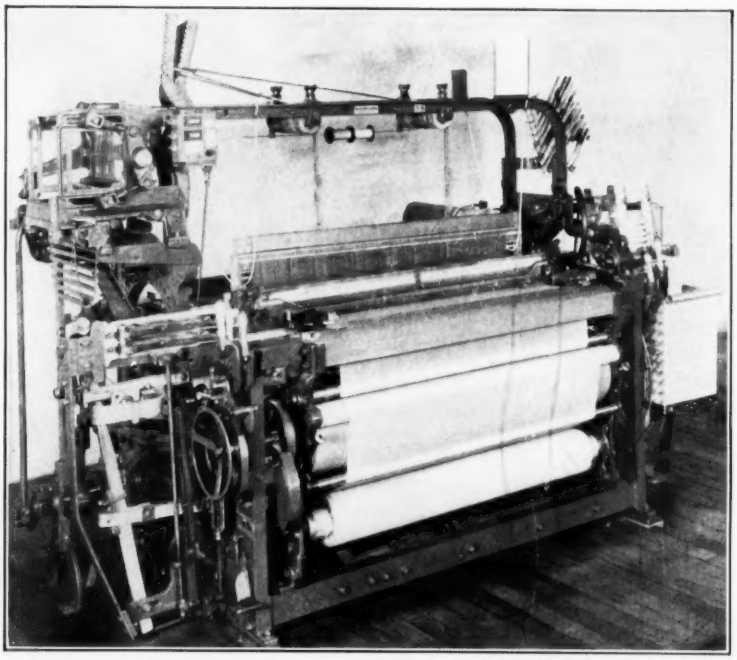
Fig. 13—The Draper XD model loom for rayon and spun silk. Lubrication of this loom is discussed in detail by the manufacturer in a specially prepared pamphlet.

the source of these latter, there may be a very slight tendency toward this phenomenon. In general, however, soaps are produced directly from fixed oils or fats. The chemistry of petroleum has indicated that the same result may be obtained by the action of an alkali upon a fatty acid. The term saponification, therefore, may also be applied to the action of an alkali upon those acids of an organic nature which may be produced in a slight degree in straight petroleum oils.

Determination of Saponifying Ability

This ability of fatty oils to produce soaps has been used to advantage in the development of means for determining the presence of such an oil and its approximate volume in a mixture of mineral and fatty oils. The test is commonly known as the determination of the saponification number. Most fixed or fatty oils will react with caustic soda or potash to approximately the same degree. In other words, the equivalent amounts of the former will neutralize the alkalinity of about the same amount of caustic. In order to express this effect in a comparative manner the unit has been taken as the number of milligrams of caustic potash that will react with or be neutralized by one gram of oil. This is called its saponification number.

For most fixed or fatty oils the saponification number will range between 190 and 200. As a result, where an unknown product or lubricant is involved, by determining its saponification number a fair approximation can be made as to the amount of fatty oil contained. If the nature of this fatty oil is indicated by other tests, the percentage can be determined more exactly, inasmuch as the saponification numbers of the various pure



Courtesy of Crompton & Knowles Loom Works

Fig. 14—The Crompton & Knowles new S-5 high-speed rayon loom which operates at from 162-172 picks per minute. Lubrication of this loom has been given very careful attention by the manufacturer.

fixed oils employed by the petroleum industry are definitely known. In the opinion of certain authorities the saponification number is of real value as an indicator of the suitability of a lubricant for textile service.

INSTALLATION AND INSPECTION

In reviewing those developments which have been most outstanding in their relation to lubrication of textile machinery it is fitting to also discuss a somewhat less tangible transition which is equally as helpful in attaining protective lubrication. We have in mind the attitude of the mechanical personnel towards lubrication. They are becoming more and more convinced that this term protective lubrication is not just an advertising slogan. It is really a factor in maintenance economy and the reduction of operating costs.

To prove this point it is only necessary to make a review of lubrication practice in the mill to see where it ties in with prospective modernization programs, with machine design, with machinery manufacturers' developments and with present day trends in lubricant refining. It is rather interesting to correlate such a study item by item. Very often what would seem to be details of minor importance appear in a new light; some may even become factors of major importance with relation to the overall lubrication program.

The lubrication engineer can extend valuable assistance in view of his experience in servicing industrial machinery foreign to the textile mill, yet subject some times to similar operating conditions.

Effective lubrication begins in the drafting room with consideration of the method by which the lubricant is to be applied. It used to be popular to regard lubrication as an afterthought, the mechanisms being designed mainly with respect to their duty and the function to be performed. Oftentimes this led to inadequate capacities of oil reservoirs or location of points of lubricant application where the lubricant could not be most effective. The modern machine designer, however, gives every consideration to lubrication, also to study of methods of lubrication which are far more automatic in nature than prevailed a few years ago. These are particularly helpful where intricate mechanisms are involved and where failure due to abnormal wear might result in considerable expense, loss of time or interuption of production schedules.

Courtesy of Saco-Lowell Shops

Fig. 15—Showing how the bearings of the cross shafts, totally enclosed and protected from injury by dust and lint, are lubricated by grease applied with a modern high pressure grease gun.

Influence of Design Upon Lubricant Refinement

It is obvious that the petroleum industry must give consideration to features of design in deciding upon the degree of refinement necessary in any lubricant. Inasmuch as the textile industry is dealing with a product of highly perishable nature in that oil stains or streaks may cause rejection, the designers of textile machinery have been particularly careful in planning for protected lubrication wherever possible. This has an added advantage since the use of means which will enable retention of lubricants around the parts to be lubricated also is helpful in preventing entry of contaminating foreign matter. In textile mill operations this latter is not abrasive, it is, however, of such a nature as to cause accumulations of non-lubricating material in bearing clearances or around chain links or gear teeth

to oftentimes materially interfere with thorough penetration of fresh lubricant. Ultimately this promotes wear which may lead to misalignment and necessitate parts replacement.

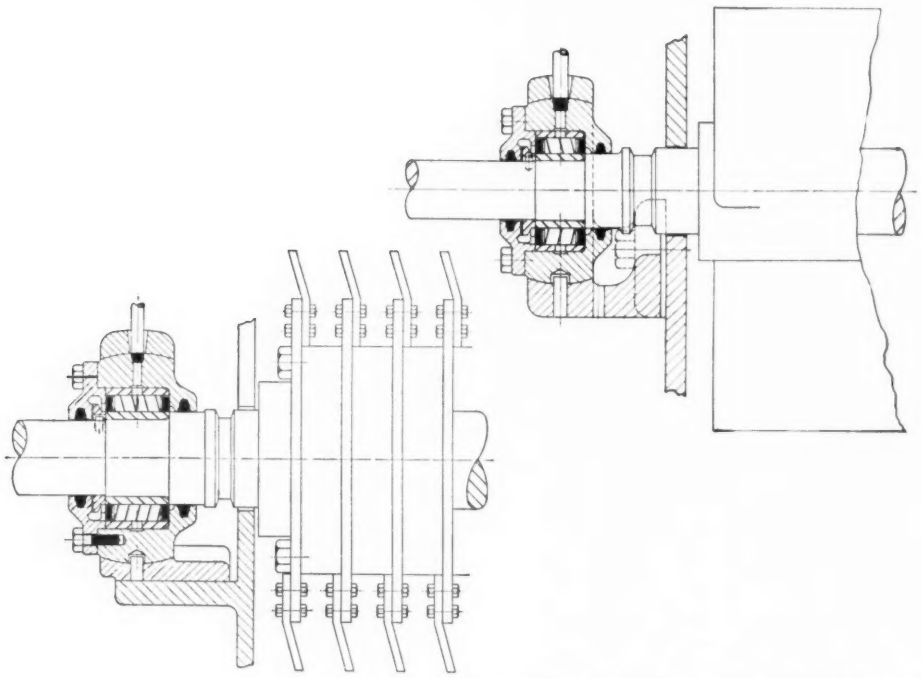
The Installation Engineer

The installation engineer also plays a distinctive part in the attainment of ultimate successful lubrication. He is responsible for initial alignment, the condition and fit of the bearings, and the manner in which lubricant equipment is installed.

Another function of the installation engineer, as well as the lubrication engineer, is to take care of primary inspection. Usually this occurs within the guarantee period after a piece of machinery has been installed and has been in operation for a certain length of time. The routine to follow requires consideration of alignment, bearing clearances, the provision made to prevent entry of water or non-lubricating foreign matter, the adaptability of the lubricating equipment to the operating requirements, the location and accessibility of oil or grease piping and control features.

Lubricant Control

Lubricant control and the assurance that the lubricating system can be depended upon to deliver the required amount of oil or grease to the moving parts of the machinery in question is absolutely essential. No matter how perfect the bearings or any other mechanism in the assembly, if there is any possibility of impaired flow or distribution of lubricant serious wear may develop.



Courtesy of Hyatt Bearings Division, General Motors Corporation

Fig. 16.—A typical Hyatt picker application. Above is shown a picker fan shaft mounting; to the left a picker beater cylinder mounting. Both of these designs have provision for controlled lubrication with adequate sealing of the bearings to prevent undue leakage.

CONCLUSION

A tribute is due to the technical and research personnel of the several industries involved, who have cooperated in perfecting lubrication in the modern textile mill. They have come to appreciate that control of lubrication is an inherent part of machine design and plant maintenance. Controlled lubrication, in turn, provides the mill operator with a means of controlling other factors which, unless controlled, might seriously interfere with the performance of some lubricants, and subsequently the productive output of the mill. Obviously any machine failure is vital when production schedules are speeded up.

Today, time out for repair is being materially decreased by the active interest of machinery builders in studying the problem of protecting equipment, reducing oil stains and increasing mill economies by employing improved means and methods of lubrication.

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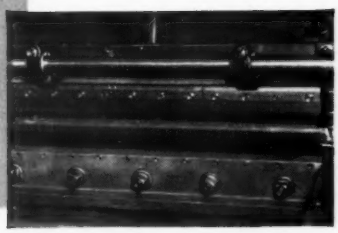
Knitting needles

PROTECTED AGAINST MOISTURE



CLOSE-UP of needles kept polished, free from rust and wear with *Texaco White Needle Oil B*, in Rosedale Knitting Mills, Reading, Pa. Rosedale reports machines free from gumming, needle life lengthened since using Texaco.

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